

# STAT 414 – MATHEMATICAL STATISTICS I

Section 502, Fall 2023

## Course description

This course is the first part of a two-semester sequence in mathematical statistics. Topics include probability, random variables and their distributions, transformations of random variables, expectations and variance, generating functions and basic limit theorems.

## Logistics

- **Instructor:** Jesús Arroyo ([jarroyo@stat.tamu.edu](mailto:jarroyo@stat.tamu.edu)), Blocker 458D.
- **Lecture:** Tue & Thu 8:00am - 9:15am, Blocker 113.
- **Office hours:** Tuesdays 4-6 pm, Blocker 458D (preferred) or Zoom (<https://tamu.zoom.us/j/93934459373>).

## Teaching Assistants

- **Main TA:** Renat Sergazinov ([mrsergazinov@tamu.edu](mailto:mrsergazinov@tamu.edu)).
- **Recitations:** Jhanvi Garg ([gargjhanvi@stat.tamu.edu](mailto:gargjhanvi@stat.tamu.edu)).
- **Alternative TA (Section 501):** Soham Ghosh ([sohamghosh@tamu.edu](mailto:sohamghosh@tamu.edu)).

## Office hours and recitations schedule

	Code:	Office hours	Recitations		
	Monday	Tuesday	Wednesday	Thursday	Friday
10:00					Jhanvi Garg (BLOC 162)
10:30					Jhanvi Garg (BLOC 162)
11:00			Renat Sergazinov (online)		
11:30			Renat Sergazinov (online)		
12:00					
12:30					
13:00				Renat Sergazinov (BLOC 162)	
13:30				Renat Sergazinov (BLOC 162)	
14:00	Jhanvi Garg (online)				
14:30	Jhanvi Garg (online)			Renat Sergazinov (405E)	
15:00	Jhanvi Garg (online)	Jhanvi Garg (BLOC 162)	Soham Ghosh (online)	Renat Sergazinov (405E)	Soham Ghosh (404E)
15:30	Jhanvi Garg (online)	Jhanvi Garg (BLOC 162)	Soham Ghosh (online)		Soham Ghosh (404E)
16:00		Jesús Arroyo (458D)			Soham Ghosh (404E)
16:30		Jesús Arroyo (458D)			Soham Ghosh (404E)
17:00		Jesús Arroyo (458D)			
17:30		Jesús Arroyo (458D)			
18:00					
18:30					
19:00	Jhanvi Garg (BLOC 162)				
19:30	Jhanvi Garg (BLOC 162)				

- In-person recitations and office hours will be held in Blocker (rooms listed on the table ).
- Virtual recitations and office hours will be held in the corresponding room as follows:
  - Soham Ghosh: <https://tamu.zoom.us/j/98809894454?pwd=MG52bDdyZlVlZ1JDMFJaczNYcjVndz09>
  - Jhanvi Garg: <https://tamu.zoom.us/j/3565779174>
  - Renat Sergazinov: <https://tamu.zoom.us/j/2314285343>

### Prerequisites

Mathematics 221, 251 or 253 (multivariable calculus).

### Course outline

1. *Basic Probability*: Introduction, Sample Space and Probability Measure, Counting methods, Conditional probability and Independence, Bayes theorem.
2. *Random Variables and Distributions*: Definitions, Cumulative Distribution Function, Discrete and Continuous Distributions, Parametric Families, Functions of Random Variables.
3. *Random Vectors and Joint Distributions*: Bivariate Discrete and Continuous Distributions, Independent Random Variables, Conditional Distributions, Multivariate Distributions, Functions of Random Vectors.
4. *Expectation and Variance*: Definitions, Moments, Covariance and Correlation, Moment Generating Function, Conditional Expectation and Variance.
5. *Limit Theorems*: Infinite Sequences of Random Variables, Law of Large Numbers, Central Limit Theorem.

### Textbook

John A. Rice, *Mathematical Statistics and Data Analysis*, 3rd ed., Duxbury.

### Course learning outcomes

By the end of the semester, students are expected to

- understand and apply the basic principles of probability,
- interpret and use conditional probability, and to understand independence,
- know the definitions of random variable and distribution,
- be familiar with common discrete and continuous distributions,
- know how to obtain or compute probabilities, expectations, variances and generating functions for various types of random variables,
- understand and work with random vectors and multivariate distributions,
- find distributions of functions of random variables,
- understand and apply the basic limit theorems of probability.

## Course links and communication

*Canvas* <https://canvas.tamu.edu/>

- All class materials, notes and homework assignments will be posted here.
- Homework submission will be done through Canvas.

*Piazza* <https://piazza.com/tamu/fall2023/stat414>

- We will be using Piazza to handle questions and discussions about class materials, assignments and exams. Please sign up with your TAMU email to the class site here: <https://piazza.com/tamu/fall2023/stat414>. The access code is 1234.
- You are encouraged to use these forums to ask questions about the class, as well as answer other classmates' questions. The TAs and the instructor will be monitoring the forums at least once a day and aim to respond within 24 hours during weekdays.
- You are also encouraged to attend office hours to talk questions directly with the instructor and TAs.

*Email*

- Please use email communication only for personal matters that cannot be solved through Piazza.
- When communicating via email, please include "STAT 414" in the subject line.

## Excused absences

- If you are unable to attend a class in person due to an *excused absence*, please contact the instructor via email before the class to request the lecture to be recorded. The instructor will share the recording with you after the class.
- For positive covid results, please follow the university guidelines <https://covid.tamu.edu/index.html>.
- If you have to miss an exam, please email the instructor as soon as possible and attach evidence of your excused absence. The instructor will discuss with you alternative plans depending on your return to campus.

## Grading Policy

- Homework assignments: 20% of the total grade.
- Midterm exams: 50% (25% + 25%) of the total grade
- Final exam: 30% of the total grade.

## Grading scale

Guaranteed grades according to the percentage performance (PP) are as follows:

$PP \geq 85\% \Rightarrow A$	$85\% > PP \geq 72.5\% \Rightarrow B$
$72.5\% > PP \geq 60\% \Rightarrow C$	$60\% > PP \geq 50\% \Rightarrow D$
$50\% > PP \geq 0\% \Rightarrow F$	

## Important Dates

See also <https://registrar.tamu.edu/Academic-Calendar>.

Last day for adding/dropping .....	Friday, August 25
Midterm 1 .....	Thursday, September 28, 2023
Midterm 2 .....	Thursday, November 9, 2023
Q-Drop deadline .....	Wednesday, November 15, 5:00pm
Last day of classes .....	Monday, December 4
Final exam .....	Friday, December 8, 2023, 1:00 - 3:00 p.m.

## Homework

- Homework assignments will be posted on Canvas, and these will typically be due one week after the assignment is announced. The tentative schedule for the homework submission deadline is the following:
  1. Homework 1: due on Tuesday, September 5.
  2. Homework 2: due on Thursday, September 14.
  3. Homework 3: due on Tuesday, September 26.
  4. Homework 4: due on Tuesday, October 12.
  5. Homework 5: due on Tuesday, October 24.
  6. Homework 6: due on Thursday, November 2.
  7. Homework 7: due on Thursday, November 16.
  8. Homework 8: due on Thursday, November 30.
- The assignments should be submitted electronically as a single PDF on Canvas by 11:59 pm of the corresponding due date.
- Late assignments submitted within 24 hours after the deadline will receive a 20% deduction of the total homework value.
- Each homework carries equal weight in the final grade. The lowest homework score will be dropped, and the final grade will be calculated based on the remaining homeworks.
- The assignments are intended to help you put in practice the concepts learned in class. The problems involve derivations and calculations, and the difficulty level might vary. It is recommended to start with the homework early, and to attend office hours and recitations if you have any questions.
- You may discuss homework problems with your colleagues, but the solutions are expected to be your individual work, consistent with the academic integrity policies of the university. You may use class notes, slides and the textbook to complete your work, and you should refrain from using other materials, such as online resources, manuals or solutions from previous years.

## Recitations and office hours

- Attending recitations is an important part of the course. The TAs will discuss additional examples and problems related to the topics covered in class.
- The recitations have been scheduled to cover a variety of times and formats to facilitate attendance. Take advantage of this resource by attending regularly and arriving on time. The TA may cancel a recitation if there is no attendance within the first 15 minutes.

- You are also encouraged to attend office hours to ask questions to the instructor and the TAs directly. Solving class problems and discussing your solutions with others is perhaps the best way to learn the class materials.
- The instructor will hold office hours in hybrid mode. Preference will be given to students attending in person. If you are attending online, please wait until a space opens or email the instructor if Zoom is not active.

## Exams

- Exams will be in class on the assigned dates. No exams may be taken early or made up, unless a university excused absence with appropriate documentation is provided.
- You must adhere to the academic integrity policies. All answers to the exams should be your own work, only using materials that are explicitly allowed.
- You can bring a formula sheet to the exam (a double-sided letter sized paper). You can also bring a calculator, as long as it is not part of a communication device. Other materials, including solutions to homeworks, class notes, textbooks, or exams are not allowed.
- Midterm exams will focus on the materials covered during the specified periods. The final exam will be cumulative and comprehensive.
- Based on university policy: if you must miss an exam due to illness or other excused absence, please notify the instructor or the Statistics Department as soon as possible (or within two business days after your return) to schedule an alternative solution. An incomplete will be given only in the event you have completed most of the work, but circumstances beyond your control cause prolonged absence from class and the work cannot be made up.

## Grading disputes

Your scores will be entered and stored on the Canvas page for the course. You are responsible for keeping track of your scores and to notify the course instructor should there be any missing grades or discrepancies. Grading dispute for an exam should be made at the end of the class session in which the exam was returned. A grading dispute might entail a regrading of the whole submission.

## University Policies

### Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments. Please refer to [Student Rule 7](#) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

### Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in [Student Rule 7](#), or other reason deemed appropriate by the instructor. Please refer to [Student Rule 7](#) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

“Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor” ([Student Rule 7](#), Section 7.4.1).

“The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence” ([Student Rule 7](#), Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See [Student Rule 24](#).)

### **Academic Integrity Statement**

“An Aggie does not lie, cheat or steal, or tolerate those who do.”

“Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one’s work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case” ([Section 20.1.2.3](#), [Student Rule 20](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at [aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

### **Americans with Disabilities Act (ADA) Policy**

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit [disability.tamu.edu](http://disability.tamu.edu). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

### **Title IX and Statement on Limits to Confidentiality**

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking. With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention — including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University’s goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need. Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services \(CAPS\)](#). Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University’s [Title IX webpage](#).

### **Statement on Mental Health and Wellness**

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing available resources and services on your campus. Students who need someone to talk to can contact [Counseling and Psychological Services \(CAPS\)](#) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

### **Copyright notice**

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